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(No. 32.)

# Metropolitan Sewers.

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LETTER OF MR BAZALGETTE, C.E.,

ON

ESTABLISHMENT OF PUBLIC CONVENIENCES.

[*Printed by Order of Court, 22nd March, 1849.*]

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24 GREAT GEORGE STREET, WESTMINSTER,  
*March, 1849.*

DEAR SIR,

With a view to forward my application to the Commissioners of Sewers for the appointment of Assistant Surveyor under the Commission I have already placed in your hands the testimonials in my favour given by gentlemen whose opinions on engineering matters would command general confidence; but as I take it for granted that the Commissioners would be desirous of forming their own opinion as to the propriety of complying with my application, I shall feel obliged by your submitting to them this paper, with the accompanying plans, at the earliest proper opportunity.

The subject which I have selected is one which appears to be of very great importance to the inhabitants of a large city, and the effectual carrying out of a scheme for affording to those who traverse its streets relief from frequent personal inconvenience and occasional pain, if not physical injury, would secure to the Commissioners the good-will of a large portion of its inhabitants. The recent sanitary inquiries are throwing so much light on many of the subjects now brought within the jurisdiction of the Commissioners, that I cannot presume to offer the following suggestions as perfect; but they may, perhaps, serve as a groundwork for improvement. With this view I have considered the subject of establishing public water-closets and urinals throughout the metropolis, and will proceed with a description of the system proposed.

## THEIR SITUATION.

Upon the accompanying map (*Wyld's Map of London*) I have marked the positions in which I would propose to erect some of these buildings at first, leaving it for time to develope where their more extended adoption is required.

At present there are but few urinals (mostly of a very primitive and insufficient kind) in existence, and as I conceive that the most profitable and effective management of such places would be accomplished by the combination of water-closets and urinals in one building, I have considered this city as at present destitute of any such accommodation, and have generally selected the foci of the main thoroughfares for their situation, and have placed them at such distances that, at the farthest, a man would have but a short walk to reach any one of them, varying this according to the density and character of the surrounding population and traffic through the streets.

There is no map in existence large enough to define the exact spot where these buildings could be placed : and indeed the position of each one must be the result of particular local inquiry and treaty. The accompanying plan will suffice to show that these establishments can be arranged to occupy an exceedingly small space, in almost any position, so as to be at once conspicuous and inoffensive, or even ornamental if required.

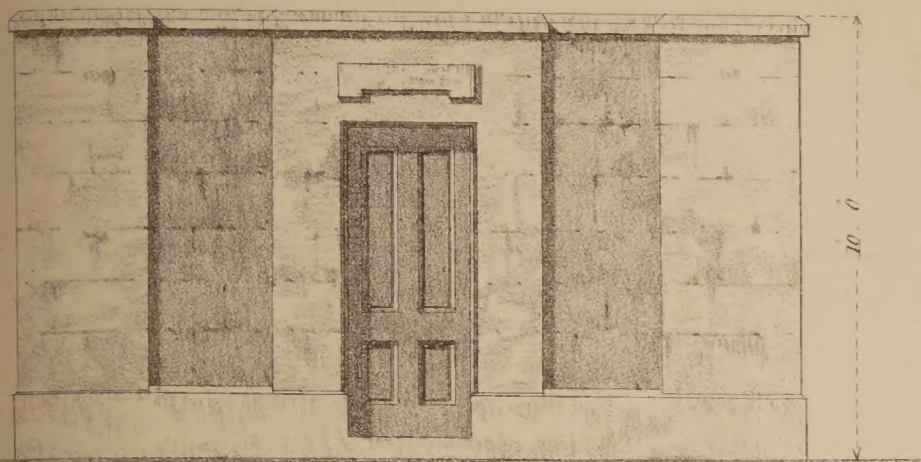
#### THEIR CONSTRUCTION.

Plan, section, and elevation A represent one of these buildings at the side of a street containing a private and two public water-closets, and four urinals, with an office for the person in charge, as hereafter described. The surrounding walls are of brickwork, either solid or hollow ; the flooring and partitions of slate, supported upon iron girders placed across the top of a tank, excavated to receive the urine ; to be lined with brickwork, and cased with tarrass cement or asphalte, furnished with a manhole, discharge pipe for pumping the urine into water-carts, and a waste pipe into the other drains. The closets and urinals to be covered by cisterns of slate or earthenware, which at the same time would serve the purposes of roofing and cleansing, to be supplied by the Commissioners or a Water Company, and furnished with a waste pipe connecting with the pans ; so that during any overflow from rains, &c., a constant scouring of the pans and pipes would occur, in addition to the flow of water arising from the use of the water-closets. The urinals should be cleansed by a copious flow of water from the tank down the wall into the drains every night and morning, or oftener if necessary ; the communication with the tank being first closed, so that the bulk of the fluid to be carted away should not be increased. The fittings of the private water-closet to be superior to those of the public ; to be covered, as well as the keeper's office, with slate roofing : the remainder of the area to be left open, to admit light and air.

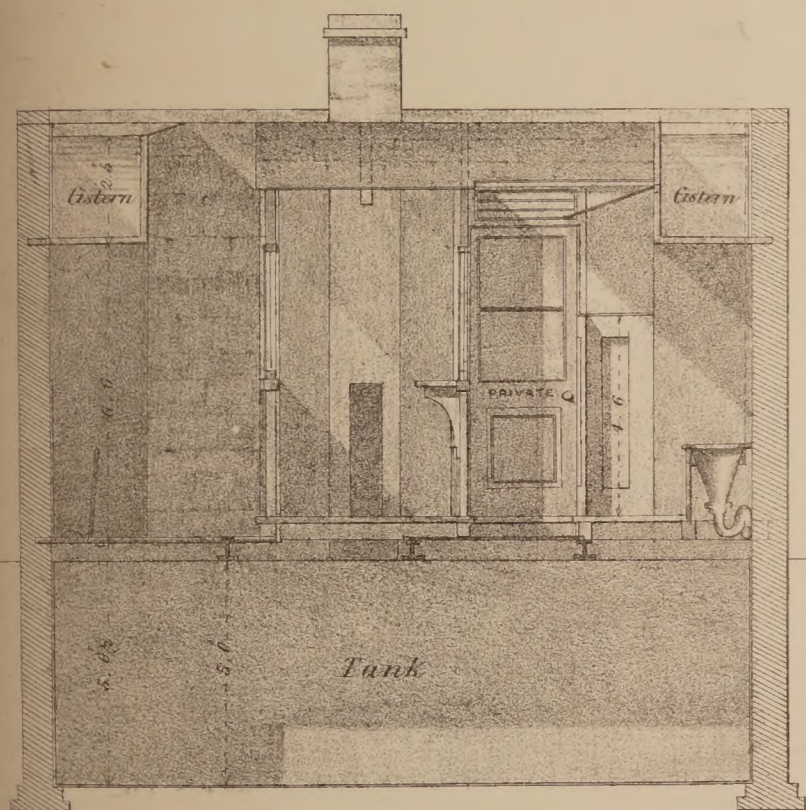
Figures B, C, and D, on the plan represent plans of buildings of similar construction arranged to suit other situations most likely to arise in carrying out this system, such as the corner of a public building or the side of a churchyard.

# DESIGNS FOR PUBLIC WATER-CLOSETS AND URINALS.

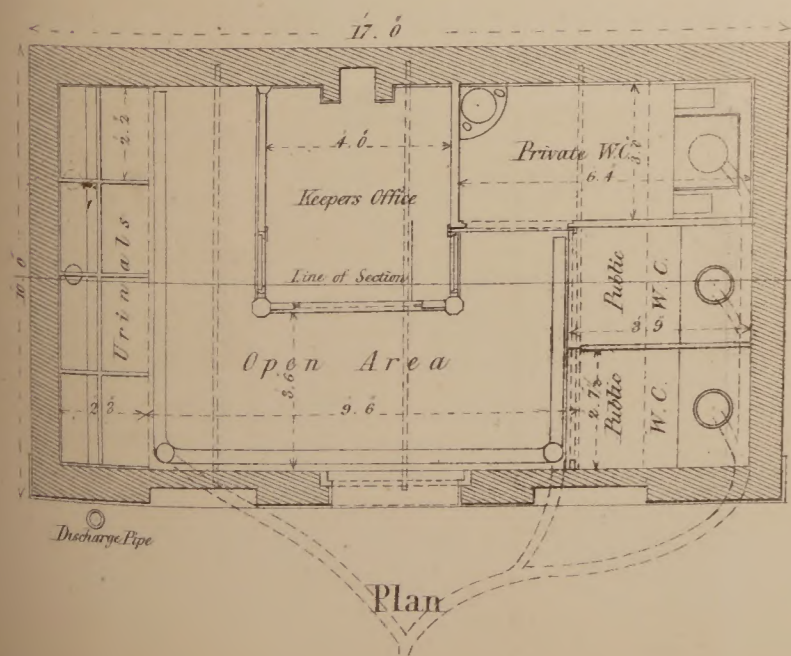
A



Elevation.

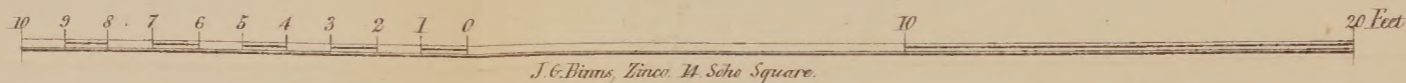


Section



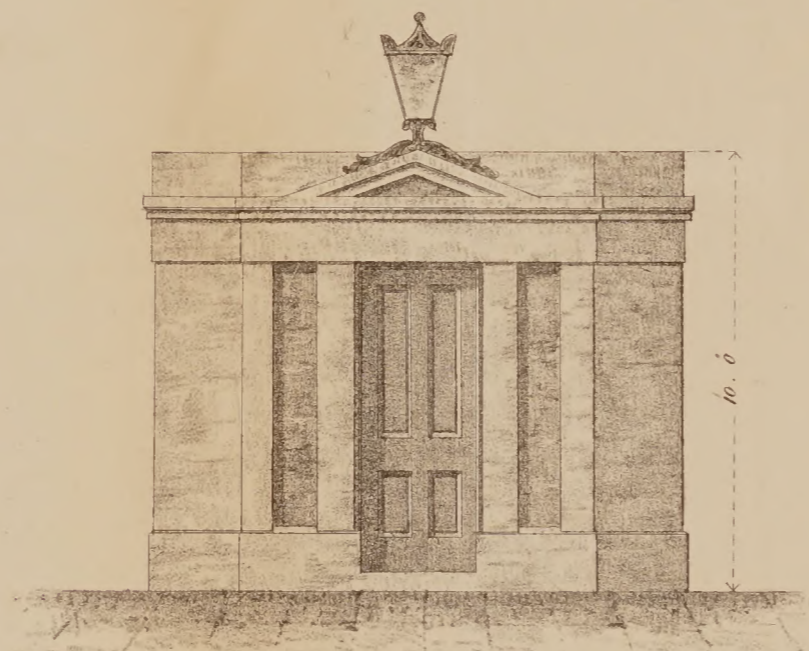
Plan

Scale.

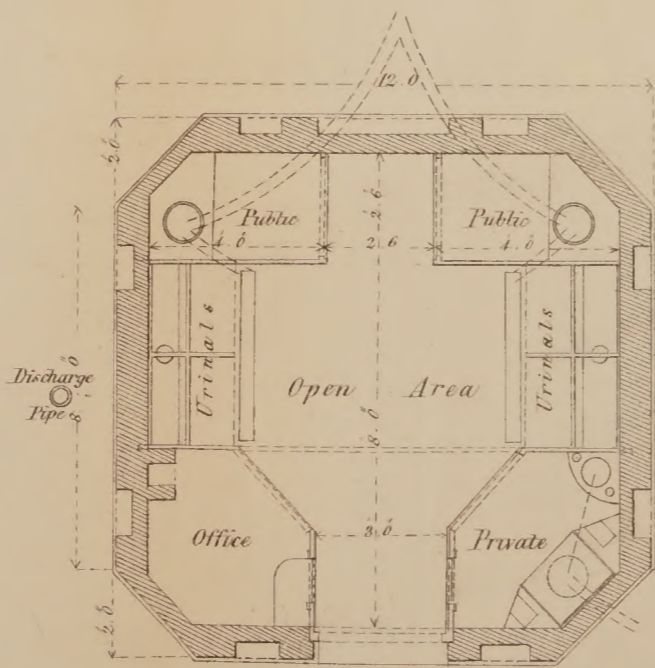


J. & D. Sims, Zincs, 14, Soho Square.

B

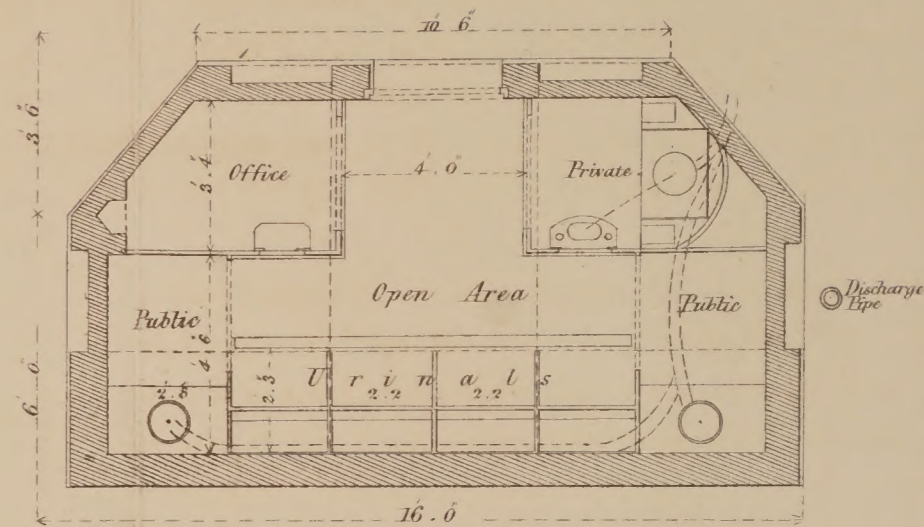


Elevation.



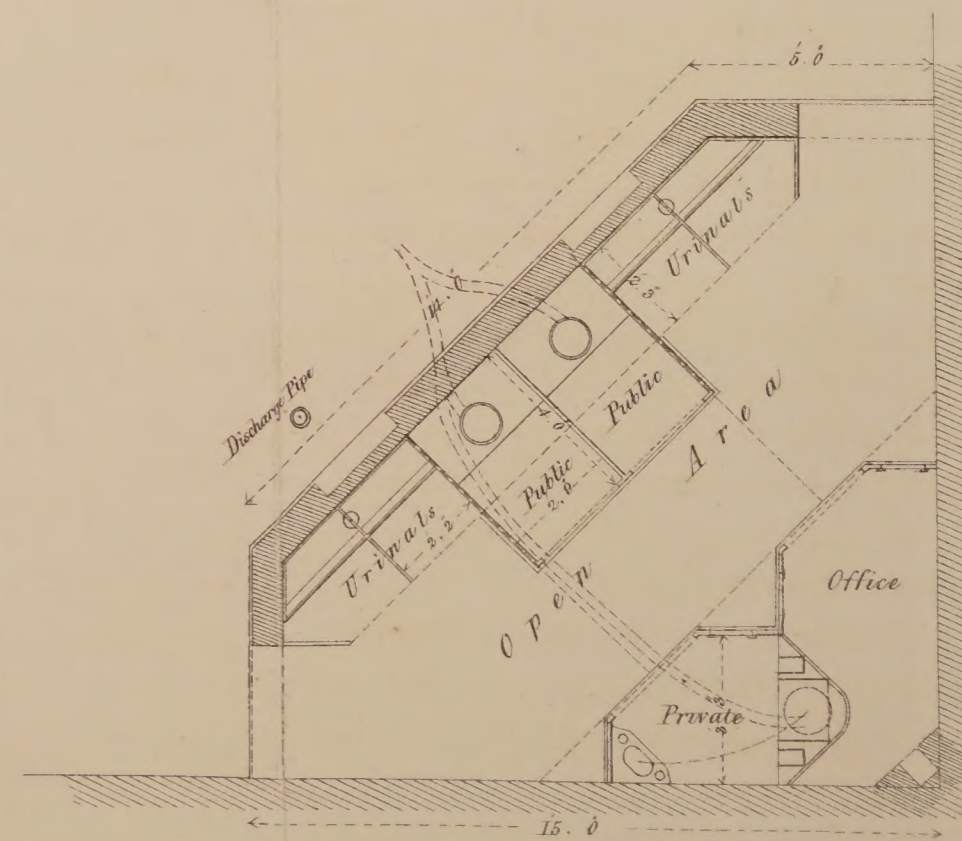
Plan.

D



Plan

C



Plan.

METROPOLITAN SEWERS  
15<sup>th</sup> March, 1849.

*J. W. Bazalgette*  
M. Inst. C.E.



THEIR MANAGEMENT.

With a population among whom are some prone to commit breaches of good order and decorum it is difficult to propose any plan which shall in itself be sufficient without taking into consideration its after management; and, as such management would form an important item of profit, it is proposed to farm these establishments like turnpikes, requiring the tenant to be constantly at his post within certain hours (after which the doors of the closets should be locked), and holding him responsible for the cleanliness and order of his charge. His situation would be such as to command a view of every one entering; the profit would arise from the sale of papers and the hire of private water-closets to those persons preferring them to the free use of the public ones, at a fixed rate of charge, and the receipt of fines in cases of nuisance or misdemeanour, which would give him a direct interest in maintaining good order and decorum.

It is proposed to construct four large reservoirs situated in the north, east, south, and west suburbs of the metropolis, carefully constructed so as to avoid any possible annoyance, into which the urine should from time to time be deposited, and where it would be increased in value as a manure by fermentation, from whence it could be conveniently distributed to the surrounding farmers and market-gardeners, to be diluted and applied by them as required. The admixture of water adding so materially to the cost of carriage, the dilution of the urine has been avoided, believing that whilst contained in a close tank there would be little or no evaporation or escape of the ammonia; and it having been ascertained that gypsum in the proportion of one quarter to one eighth per cent. fixes the ammonia, it is proposed to use this material in the suburban reservoirs.

Taking the contents of each town reservoir as shown in design A at 658 cubic feet, and assuming the constant use of the urinals for six hours per day, this reservoir would require emptying every two months into one of the suburban reservoirs, each of these receiving the contents of one-fourth, or fifteen, of the town reservoirs. Retaining it for six months, they would require to be sixty feet long, fifty feet wide, and ten feet deep, containing 30,000 cubic feet.

THEIR PROFIT.

This would arise from two sources, viz., their management and the sale of the contents of the tank, to ascertain the probable amount and value of which I have made the following observations.

At a urinal at the Royal Exchange, accommodating three persons at one time, there were counted from

10	to 10 30	A.M.	50	persons	} This being the greatest number the place could accommodate in the time occupied.
1 30	to 2	P.M.	90	„	
7 30	to 8	P.M.	61	„	

At the back of the Bank, with accommodation for two persons at one time, the number observed from 2 to 2 30 P.M. was sixty, that being the greatest number the place could accommodate.

At the back of the National Gallery, with accommodation for four persons at one time, the number observed was

From 9 30 to 10	A.M.	28	persons.
12 to 12 30	P.M.	86	„
7 45 to 8 15	P.M.	80	„

At the Mansion-house, with accommodation for two persons at one time, the numbers were—

From 9 30 to 10	A.M.	26	persons.
2 to 2 30	P.M.	54	„
8 to 8 30	P.M.	35	„

At the corner of Hyde Park, with accommodation for four persons, the number observed was—

From 10 to 10 30	A.M.	50	persons.
7 45 to 8 15	P.M.	46	„

In estimating the size of the reservoir, a continuance of the greatest possible traffic (as shown by the above observations) is assumed for twelve hours per day; and taking the average deposit of urine at half-a-pint per individual (ascertained upon medical authority), the four urinals would produce twenty-six cubic feet per diem. A reservoir of the area shown upon the plans, five feet deep, would require emptying every twenty-five days. It is probable, however, that this is taking an extreme view of the case, and that with the extended accommodation afforded by these conveniences, the reservoir would contain the fluid for double that time.

Taking this more moderate view of the case, and assuming that each urinal is only occupied four hours each day, we have four hundred and eighty pints per day. The average quantity of urine discharged by each individual in the twenty-four hours being three pints, the accumulation of this deposit has been valued by Professor Johnson at six shillings per annum for each person. We have, then, as the value of the produce of the four urinals, forty-eight pounds per annum. This sum appears large, and it is possible that but a small portion, or even no part of it, would at once be realised. It would probably be necessary to establish its value by conveying it to the farmers and market-gardeners at prices scarcely remunerating for the outlay and plant for removing. This would require an agent, whose business it should be to secure its extended trial in comparison with other manures. If, however, such authority as that of Professor Johnson, supported by others, is to be

relied upon, and the scheme properly worked, there can be no doubt that the result must eventually prove a decidedly profitable speculation.

In proof of this, the experiments made by M. Maxime Paulet, described in his work "*Théorie et Pratique des Engrais*," showing the following results, are offered, the weights and measures used by M. Paulet being reduced to the English standard.

M. Paulet takes the quantity of azote (nitrogen) contained by the manure as determining its value, and assumes as a standard of comparison farm-yard manure, which contains four per mille of azote, 35·288 lbs. of azote being required to manure one acre of land.

This would require of—

	lbs.
Good farm-yard manure - - - -	8,820
Human urine not having undergone fermentation -	4,939
Poudrette of Montfaucon - - - -	1,985
Mixed human excrements and blood from the abattoirs -	1,175
Bones - - - - -	573
Guano, average taken from two specimens - -	452
Urine in a state of fermentation, and imperfectly dried, from the public urinals - - - -	205

The comparison between this latter and good farm-yard manure being as one to forty-three; bones, one to two and four-fifths; and guano, as one to two and one-fifth.

Assuming that only 60 people use the water-closets in 24 hours, two-thirds of them purchasing paper at one halfpenny each -	£0	1	8	per day.
One-third pay 2d. each for a private water-closet -	0	3	4	
	<hr/>			
	0	5	0	
	<hr/>			
Or per annum - - - -	91	5	0	
Deduct keeper's wages, 25s. per week -	65	0	0	
	<hr/>			
Leaving a clear profit from this source of -	26	5	0	
To which may be added fines.				

In the following estimate of the cost of construction of these buildings I have assumed the use of the best materials at the current prices of the day; but considering the improvements and economy now in progress through the efforts of this Commission and others, I have no doubt that they will be constructed at a smaller cost.

## ESTIMATE OF URINALS, &amp;c.

	£	s.	d.
Excavation, 49 yards, at 2s.	-	-	4 18 0
Brickwork, $1\frac{1}{11}$ rods reduced work, 11l. 10s.	-	-	21 19 0
Cement lining to tank, 43 yards, at 2s. 6d.	-	-	5 7 6
Tile paving, coping to ditto	-	-	4 4 0
Iron girders, 6 cwt., at 10s.	-	-	3 0 0
Slate paving, at per foot super., 1s. 4d.	-	-	6 17 6
Slate partitions, cisterns, &c., at 1s. 8d.	-	-	14 14 5
Weather-boarding and lining to office	-	-	6 18 8
Bringing on water - - - - -	-	-	5 0 0
Roofing, flooring, doors, windows, pans, drains, and fittings complete, taken out in detail - - - - -	-	-	23 3 9
Total - - - - -	-	-	<u>96 2 10</u>

Having seen a liquid manure cart, built for a gentleman at Banstead in Surrey, containing 505 gallons, being about eighty-one cubic feet, or (taking urine as equal in weight to salt water, at sixty-seven pounds to the cubic foot)  $2\frac{1}{2}$  tons, which is one-eighth part of the town reservoir; therefore, assuming that each of these carts would on the average make two journeys per day from the town to the suburban reservoirs, it would take one cart four days to empty each town reservoir, which, if required every two months, would give regular employment to one cart and three horses for each suburban reservoir.

According to Professor Johnson's standard of the value of urine, it is worth 9s. 2d. per ton; and one of these carts would contain about 23s. worth of urine.

## GENERAL ESTIMATE.

Construction of 60 urinals, &c.	-	-	£6,000
Ditto 4 suburban reservoirs and stables	-	-	4,000
Purchase of 6 water-carts at 30l. each	-	-	180
„ 12 horses and harness, at 30l.	-	-	360
„ pumps, hose, &c.	-	-	160
			<u>10,700</u>
Contingencies, 10 per cent.	-	-	1,070
			<u>11,770</u>

## ANNUAL WORKING EXPENSES—

Keep of 12 horses, at 10s. each per week	-	£312
Wages of 8 men, at 20s. each per week	-	416
Wear and tear of horses, carts, &c., taken at 20 per cent - - - - -	-	144
Supervision, offices, printing, &c.	-	728
		<u>£1,600</u>



In the above estimate, provision is made for removing the produce of the urinals taken at six hours per day; but in estimating their produce as worth 48*l.* per annum, it has been calculated at only four hours per day; which is, in fact, deducting one-third from the revenue which might be realised without addition to the estimated capital and working expenses.

Taking, therefore, the produce of sixty urinals at 48 <i>l.</i> per annum each	£2,880
From which deduct working expenses	- - - 1,600
There is left a balance of profit of	- - - <u>1,280</u>

being more than 10 per cent. upon the capital of 11,770*l.* from this source alone.

Until, however, the attention of manufacturers, dyers, farmers, and gardeners has been called, and a free demand established for this article, there is a source of revenue to be derived from the use and management alone of these establishments, as before shown, yielding 26*l.* 5*s.* each per annum

	- - - £1,575
Deduct 10 per cent. for wear and tear	- - - £600
„ for management, &c.	- - - 375
	- - - <u>975</u>

Leaving a profit of - - - - £600

or 5 per cent. upon a capital of 12,000*l.* upon the worst view of the case; showing the speculation, therefore, a safe one.

Upon the map of London I have marked the situations for about sixty of these buildings, considering that the carrying out this scheme, including the construction of the four suburban reservoirs and the purchase of water-carts, would require a capital of from ten to twelve thousand pounds. Should the Commissioners approve of the plan and give it their support, I have no doubt of being able to find a few individuals who would be willing to undertake the scheme as a speculation at their own expense, under the general supervision of the Commission; the Commissioners giving power to build upon the spots selected, assuming that the buildings would generally be erected on land already devoted to the public, and that, for the sake of securing a great public benefit, the Commissioners would not find any serious impediment offered by other authorities; the Company sharing the profit with the Commission, after realising say ten per cent. upon the outlay, or some similar arrangement to be the subject of future decision.

I am, &c.,  
 J. W. BAZALGETTE,  
 Mem. Inst. C.E.

The Clerk of the Metropolitan Commissioners  
 of Sewers, &c. &c.

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(No. 32.)

**Metropolitan Sewers.**

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**LETTER**

OF

**MR J. W. BAZALGETTE**

ON

**ESTABLISHMENT OF PUBLIC  
CONVENIENCES**

**THROUGHOUT THE METROPOLIS.**

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*Printed by Order of Court, 22nd March, 1859*

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